In the United States Patent and Trademark Office

Appn. Number:_____

Appn. Filed:_____

Applicant(s): JOHS ET AL.

Appn. Title: ROTATING OR ROTATABLE COMPENSATOR SPECTROSCOPIC ELLIPSOMETER...

Examiner/GAU:_____ /324

Mailed: WITH APPLICATION

At:_____

Information Disclosure Statement

Commissioner of Patents and Trademarks
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon.

Following are comments on these references pursuant to Rule 98:

THE IDENTIFIED PATENTS AND ARTICLES ARE NOT ACCOMPANYING AS THEY WERE PREVIOUSLY SUBMITTED IN CO-PENDING APPLICATIONS AND ARE AVAILABLE IN THE FILES OF SAID APPLICATIONS:

Co-Pending Application Serial No. 09/583,229 Filed 05/30/2000;
Co-Pending Application Serial No. 09/945,962 Filed 09/04/2001;
Co-Pending Application Serial No. 10/034,800 Filed 12/28/2001;
Co-Pending Application Serial No. 10/699,540 Filed 11/01/2003;

IDENTIFIED PATENTS

Patents of which the Inventor is aware include those to:

Woollam et al, No. 5,373,359,
Johs et al. No. 5,666,201
Green et al., No. 5,521,706,
Johs et al., No. 5,504,582

and are disclosed for general information as they pertain to ellipsometer systems.

Further Patents of which the Inventor is aware include:

Nos. 5,757,494 and 5,956,145 to Green et al., in which are taught a method for extending the range of Rotating Analyzer/Polarizer ellipsometer systems to allow measurement of DELTA'S near zero (0.0) and one-hundred-eighty (180) degrees, and the extension of modulator element ellipsometers to PSI'S of forty-five (45) degrees. Said Patents describes the presence of a variable, transmissive, bi-refringent component which is added, and the

application thereof during data acquisition to enable the identified capability.

Patent No. 5,706,212 to Thompson et al. is also disclosed as it teaches a mathematical regression based double Fourier series ellipsometer calibration procedure for application, primarily, in calibrating ellipsometers system utilized in infrared wavelength range. Bi-refringent, transmissive window-like compensators are described as present in the system thereof, and discussion of correlation of retardations entered by sequentially adjacent elements which do not rotate with respect to one another during data acquisition is described therein.

Patent to He et al., No. 5,963,327 is disclosed as it describes an ellipsometer system which enables providing a polarized beam of electromagnetic radiation at an oblique angle-of-incidence to a sample system in a small spot area.

Patent to Johs et al., No. 5,872,630 is disclosed as it describes an ellipsometer system in which an analyzer and polarizer are maintained in a fixed in position during data acquisition, while a compensator is caused to continuously rotate.

Patent to Dill et al., No. 4,953,232 is disclosed as it describes a rotating compensator ellipsometer system.

Patents disclosed as they Claim various Compensator Designs are:

No. 5,946,098 to Johs et al.;
No. 5,963,325 to Johs et al.;
No. 6,084,674 to Johs et al.;
No. 6,084,675 to Herzinger et al.;
No. 6,100,981 to Johs et al.;
No. 6,118,537 to Johs et al.;
No. 6,141,102 to Johs et al.

Patent 4,556,292 to Mathyssek et al. and

Patent No. 5,475,525 to Tournois et al.;

are disclsoed as they were cited in examination of some of the just disclosed Patents.

Patent to Coates et al., No. 4,826,321 is disclosed as it describes applying a reflected monochromatic beam of plane polarized electromagnetic radiation at a Brewster angle of incidence to a sample substrate to determine the thickness of a thin film thereupon. This Patent also describes calibration utilizing two sample substrates, which have different depths of surface coating.

Other Patents which describe use of reflected electromagnetic

radiation to investigate sample systems are:

RE 34,783, 4,373,817, and
5,045,704 to Coates.

Patent to Bjork et al., No. 4,647,207 is disclosed as it describes an ellipsometer system which has provision for sequentially positioning a plurality of reflective polarization state modifiers in a beam of electromagnetic radiation. While said 207 Patent mentions investigating a sample system in a transmission mode, no mention or suggestion is found for utilizing a plurality of transmitting polarization state modifiers. Patent Nos.:

4,210,401;
4,332,476; and
4,355,903;

are also identified as being cited in the 207 Patent. It is noted that systems as disclosed in these Patents, (particularly in the 476 Patent), which utilize reflection form an element to modify a polarization state can, if such an element is an essential duplicate of an investigated sample and is rotated ninety degrees therefrom, the effect of the polarization state modifying element on the electromagnetic beam effect is extinguished by the sample.

Patent to Mansuripur et al., No. 4,838,695 is disclosed as it describes an apparatus for measuring reflectivity.

Patents to Rosencwaig et al., Nos.:

4,750,822; and
5,595,406

are also identified as they describe systems which impinge electromagnetic beams onto sample systems at oblique angles of incidence. The 406 Patent provides for use of multiple wavelengths and multiple angles of incidence. For similar reasons Patent No.:

5,042,951

to Gold et al. is also disclosed.

Patent to Osterberg, No. 2,700,918 describes a microscope with variable means for increasing the visibility of optical images, partially comprised of discrete bi-refringent plates which can be positioned in the pathway between an eyepiece and an observed object. Other Patents identified in a Search which identified said 918 Patent are Nos.:

3,183,763 to Koester;
4,105,338 to Kuroha;
3,992,104 to Watanabe;

and a Russian Patent, No. SU 1518728. Said other Patents are not believed to be particularly relevant, however.

Patent No. 5,329,357 to Bernoux et al. is also identified as it Claims use of fiber optics to carry electromagnetic radiation to and from an ellipsometer system which has at least one polarizer or analyzer which rotates during data acquisition. It is noted that if both the polarizer and analyzer are stationary during data acquisition that this Patent is not controlling where electromagnetic radiation carrying fiber optics are present.

Patent No. 6,628,917 to Johs is disclosed as present invention preferred practice is to utilize a spectroscopic source of electromagnetic radiation with a relatively flat spectrum over a large range of wavelengths.

Patent to Chen et al., No. 5,581,350, is disclosed as it describes a method for regression calibration of ellipsometers.

Patent No. 6,608,526 to Piwonka-Corle et al is disclsoed, as is

Patent No. 5,596,411 to Fanton et al.,

as the Applicant is aware thereof.

Patents which focus on the use of Lenses in Ellipsometer Systesm are:

Patent Nos. 5,877,859 and 5,798,837 to Aspnes et al.;
Patent No. 5,333,052 to Finarov;
Patent No. 5,608,526 to Piwonka-Corle et al.;
Patent No. 5,793,480 to Lacy et al.;
Patent Nos. 4,636,075 and 4,893,932 to Knollenberg; and
Patent No. 4,668,860 to Anthon.

Patent found is No. 5,917,594 to Norton is the most relevant the system disclosed therein utilizes a spherical mirror to focus an electromagentic beam onto the surface of a sample in the form of a small spot.

IDENTIFIED SCIENTIFIC PAPERS

A paper by Johs, titled "Regression Calibration Method for Rotating Element Ellipsometers", Thin Solid Films, 234 (1993) is also disclosed as it describes a mathematical regression based approach to calibrating ellipsometer systems.

Another paper, by Gottesfeld et al., titled "Combined

Ellipsometer and Reflectometer Measurements of Surface Processes on Nobel Metals Electrodes", Surface Sci., 56 (1976), is also identified as describing the benefits of combining ellipsometry and reflectometry.

A paper by Smith, titled "An Automated Scanning Ellipsometer", Surface Science, Vol. 56, No. 1. (1976), is also mentioned as it describes an ellipsometer system which does not require any moving, (eg. rotating), elements during data acquisition.

Additional papers, by Azzam and Azzam et al. are also identified as concerning alternative approaches to the goal of the present invention, and are titled:

"Multichannel Polarization State Detectors For Time-Resolved Ellipsometry", Thin Solid Film, 234 (1993); and

"Spectrophotopolarimeter Based On Multiple Reflections In A Coated Dielectric Slab", Thin Solid Films 313 (1998); and

And two more papers by Azzam et al. are also disclosed:

"General Analysis And Optimization Of The Four-Detector Photopolarimeter", J. Opt. Soc. Am., A, Vol. 5, No. 5 (May 1988); and

"Accurate Calibration Of Four-Detector Photopolarimeter With Imperfect Polarization Optical Elements", J. Opt. Soc. Am., Vol. 6, No. 10, (Oct. 1989);

A review paper by Collins, titled "Automatic Rotating Element Ellipsometers: Calibration, Operation and Real-Time Applications", Rev. Sci. Instrum., 61(8) (1990), is identified for general information.

SINCERELY,

JAMES D. WELCH
REG. NO. 31,216

Form PTO-1449 (REV. 7-80) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO. | SERIAL NO.

APPLICANT Johs eTal.

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LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5373359	12/1994	Woollam eTal	356	328	
	AB	5666201	9/1997	Johs eTal	356	369	
	AC	5521706	5/1996	Green eTal	356	369	
	AD	5504582	4/1996	Johs eTal	356	369	
	AE	5757494	5/1998	Green eTal	356	369	
	AF	5956145	9/1999	Green eTal	356	364	
	AG	5706212	1/1998	Thompson eTal	364	525	
	AH	5963327	10/1999	He eTal	356	369	
	AI	5877630	2/1999	Johs eTal	356	369	
	AJ	4053232	10/1997	Dill eTal	356	118	
	AK	5946098	8/1999	Johs eTal	356	364	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
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	AA	5963325	10/1999	Johs. eTal	356	364	
	AB	6084674	7/2000	Johs eTal	356	364	
	AC	6084675	7/2000	Herzinger eTal	356	369	
	AD	6100981	8/2000	Johs eTal	356	364	
	AE	6118537	9/2000	Johs eTal	356	369	
	AF	6141102	10/2000	Johs. eTal	356	364	
	AG	6268917	7/2000	Johs	356	369	
	AH	4555629	12/1985	Mathyssek eTal	350	394	
	AI	5471555	12/1995	Journois eTal	359	245	
	AJ	4826321	5/1989	Coates eTal	356	351	
	AK	RE34783	11/1994	Coates	250	372	

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ATTY. DOCKET NO. | SERIAL NO.

APPLICANT John et al

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	4373817	2/1983	Coates	356	384	
	AB	5045704	9/1991	Coates	356	448	
	AC	4647207	3/1987	Bjorkeetal	356	365	
	AD	4241040	7/1980	Batten	356	365	
	AE	4332476	6/1982	Stenbergs et al	356	365	
	AF	4355903	10/1982	Sandercock	356	382	
	AG	4838695	6/1989	Mansuripur et al	356	365	
	AH	4750822	6/1988	Rosencwaig et al	356	445	
	AI	5042957	8/1991	Gold et al	356	365	
	AJ	2700918	2/1955	Osterberg et al			
	AK	3183763	5/1965	Koester			

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	AA	4105338	8/1978	Furuha	356	118	
	AB	3992104	11/1976	Watanabe	356	117	
	AC	5329357	7/1994	Bernoux et al	356	369	
	AD	5578135	12/1996	Chen et al	356	369	
	AE	5608526	3/1997	Piwonka-Corle et al	356	369	
	AF	5559611	1/1997	Fanton et al.			
	AG	5877858	3/1999	Aspnes et al	356	364	
	AH	5798823	8/1998	Aspnes et al	356	369	
	AI	5333652	7/1994	Fingarov	356	369	
	AJ	5608526	3/1997	Piwonka-Corle et a	356	369	
	AK	5793480	8/1998	Lacey et al	356	73	

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U.S. PATENT DOCUMENTS

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	AA	4636075	1/1987	Knollenbers	356	336	
	AB	4893932	1/1990	Knollenbers	356	369	
	AC	4688605	5/1987	AnThon	250	225	
	AD	5917594	6/1999	NorJon	356	327	
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	AK						

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Form 10-6

Johs etal 5 of 5

PLEASE USE THE FOLLOWING FOR PTO FORM 1449 FOR ARTICLES

Paper by Johs, titled "Regression Calibration Method for Rotating Element Ellipsometers", Thin Solid Films, 234 (1993).

Paper, by Gottesfeld et al., titled "Combined Ellipsometer and Reflectometer Measurements of Surface Processes on Nobel Metals Electrodes", Surface Sci., 56 (1976).

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